THE NATURE OF VOLUNTARY MUSCULAR CONTRACTIONS.—Prof. Christian Löven, in a paper read at the Scandinavian Naturalists' Congress, 1880, and published in the *Nordiskt Med. Arkiv*, xiii, 1, No. 5, 1881, after having noticed the fact that the very numerous investigations on the functions and properties of nerves and muscles have yet left only too much to be desired in the way of explanation of the most common phenomena manifested in the living healthy organism, and especially of those relative to voluntary tonic contractions, reviewed the various opinions on this subject, and distinguished three, essentially differing from each other, viz.:

1. That which holds that these contractions are truly continuous, *i. e.*, engendered by a continuous excitation of the nervous centres.

2. The opinion admitting that the central apparatus, and, first of all, those of the spinal cord, can only transmit their excitations to the muscles by separate discharges, following in this a definite rhythm for each species of animal (in many, according to Helmholtz, this would be 18-20 per second, in the frog 16-18 per second).

3. And last, that of M. Brücke, holding that the apparent continuity of the tonic contraction is due to the fact that the discharges are not perfectly isochronous in all the nerve fibres supplying a muscle, but resemble rather "volley firing."

Decisive proofs of all these views are lacking. The first is based upon the generally admitted fact, that voluntary contraction, as well as strychnine tetanus, never produces "secondary" or induced tetanus in the paw of the galvanoscopic frog, the nerve of which has been applied to the contracted muscle. The second, which may be considered the predominant one at the present time, supports itself by the analogy with artificial tetanus, and especially by the muscular sound. The third view, finally, has scarcely any other thing in its favor than the desire to show the difficulty presented by the absence of induced tetanus.

Thanks to the extreme sensitiveness of a capillary electrometer the author was able to show in 1879 (*Nordiskt Med. Arkiv*, xi, No. 14) that the voluntary tonic contractions in the toad, also strychnine tetanus in that animal as well as in the frog, are accompanied with well-marked and regular rhythmic electric variations. But the number of these variations being only about eight per second (instead of 16-18 according to the reigning opinion), it becomes very difficult to explain to one's self how in volun-

tary contractions and strychnine tetanus muscular jerks so widely separated in point of time could so fuse themselves as to form an apparently continuous contraction, especially when we consider that ordinarily as many as 20 excitations, and even more per second, are needed to cause a perfect electric tetanus.

The author thinks that the simplest method of obtaining a solution of this difficulty would be to admit that the physiological excitations sent to the muscles from the motor centres differ in some essential property from those we give to the motor nerves in laboratory experiments, and notably differ in the fact that they are slower. In fact, these oscillations provoked in the capillary electrometer by voluntary and strychnic contractions appeared to M. Löven to possess this property, though naturally the difficulty of reaching perfect certainty in this regard ought to be very great. Furthermore, amongst the whole of the facts obtained by experimental excitation of the motor nerves, we find some that show, as far as we can judge by the form of the muscular curve, that the character, or, if we choose, the form of the motor excitations is not always the same. It suffices to recall the slow contractions that appear when a part of the nerve by which the excitation should pass, is chilled, and also the contractions which, in certain cases, are provoked by the opening of a continuous current.

If the physiological excitations are distinguished by their slowness, the inability of a voluntary contraction to produce an induced contraction ought not to be so difficult to comprehend, seeing that it is necessary, in order to excite the nerve of the galvanoscopic paw, that the electric variations in the "inductor" muscle should have not only a sufficient intensity but a certain celerity; and therefore the fusion of these slow contractions into a continuous tetanus ought not to appear strange, even if the number of the muscular jerks per second does not exceed the eight oscillations above mentioned.

The study, by the aid of the electrometer, of the electric variations that accompany voluntary and strychnic contractions reveals still other peculiarities that appear to M. Löven to be of capital importance, especially for the explanation of certain pathological conditions of the motor functions. These oscillations vary, not only in their rhythm, and that in direct proportion to the energy of the contractions, but also, as the author thinks, very notably in quickness, being sometimes slower, sometimes faster.

M. Löven thinks that these differences can hardly have any

other cause than a regulator action already exerted in the nerve centres. It would evidently be very difficult and altogether unprofitable, in the present state of our knowledge, to try to formulate hypotheses in regard to the organs that may exercise this function, or as to their probable mode of action; but the cases where this regulating influence is lacking are very easily recognized.

One of these cases presents special points of interest, inasmuch as it still belongs to the physiological domain; it is the tremor that is seen in strongly contracted muscles when we seek to overcome a resistance by the greatest possible effort. In order to see if the oscillations of such a tremor follow any constant rhythm, Löven registered graphically by a very simple procedure the oscillations that occur in the muscles of the arm when an attempt is made to flex a very resistant bar of steel, and he found that in a number of healthy persons the rhythm of these oscillations was very regular at 12-13 per second.

He thinks that we may admit, without too much assumption, that these oscillations are, in fact, nothing else than the expression of the simple muscular contractions, which in an excessive effort of the motor centres cannot be sufficiently blended to produce a perfect continuous tetanus.

At the end of his paper M. Löven called attention to various applications that could be made of these views in the explanation of certain characteristic phenomena of some pathological conditions of the motor system.

VASO-MOTORS OF THE LYMPHATICS.—MM. Paul Bert and Laffont have, by opening the abdomen of an animal in the full process of digestion under warm water, discovered the vaso-motor nerves of the lymphatics. In this operation, the chyliferous vessels appear as white cords, and nodosities are formed along them by excitation of the solar plexus or the great splanchnic nerve. Their experiments were reported to the Société de Biologie, April 2, of this year.

ORIGIN OF THE CRANIAL NERVES.—Duval (*Progrès Médical*, Nos. 15 and 16, 1881), before the Paris Biological Society, read a paper on the subject of the cranial nerves originating as spinal nerves with intumescences, in which he dealt more especially with the olfactory and fifth pair. The ganglion of Gasser is